Electronics: AC Circuit Fundamentals (30S)

Instructor: Mr. Pulver
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Course Code: EXA30S
Credit: 1.0
Prerequisite: Introduction to Electronics Technology (20S)
Suggested Grade Level: Grade 10 or 11
Delivery Format: Classroom instruction, math-based analysis, circuit simulations, and hands-on labs

Course Description

This course provides students with an in-depth understanding of alternating current (AC) circuits and their applications. Students will learn how reactive components interact in AC systems and explore concepts such as impedance, resonance, power factor, and frequency-dependent behavior. Emphasis is placed on mathematical analysis, oscilloscope usage, and real-world circuit implementation.

General Learning Outcomes (GLOs)

- Explain the generation and properties of AC signals.
- Analyze the behavior of resistors, capacitors, and inductors in AC circuits.
- Calculate impedance and use phasors to solve AC circuit problems.
- Understand and measure real, reactive, and apparent power.
- Explore frequency-dependent behavior including resonance and filtering.
- Use oscilloscopes, function generators, and multimeters effectively.
- Apply AC theory in practical power systems and applications.

Unit Breakdown

Unit 1: Introduction to AC Circuits

- Definition of AC vs. DC
- AC waveform properties: frequency, amplitude, phase
- RMS and peak values

Unit 2: Behavior of Circuit Components in AC

- Voltage and current relationships in resistors, capacitors, and inductors
- Phase shifts and energy storage

Unit 3: Impedance and Phasor Analysis

- Impedance in series and parallel
- Vector (phasor) representation of AC quantities
- Complex numbers in AC analysis

Unit 4: Power in AC Circuits

- Real, reactive, and apparent power
- Power factor and correction techniques
- AC power triangle

Unit 5: Resonance in AC Circuits

- Series and parallel resonance
- Applications in tuning and filtering
- Q factor and bandwidth

Unit 6: Measuring Instruments in AC Circuits

- Using oscilloscopes, multimeters, and function generators
- Waveform analysis and phase comparison
- Practical troubleshooting tips

Unit 7: Applications of AC Circuits

- Transformers and power distribution
- AC motors and basic control
- Filtering and amplification in audio circuits

Unit 8: Capstone Project

- Design and build an AC-based system (e.g., filter, power supply, dimmer circuit)
- Include schematics, testing, and final report

Assessment

- Labs and Theory Assignments 40%
- Quizzes and Participation 20%
- Capstone Project 30%
- Final Exam 10%

Resources

- Oscilloscope and function generator for waveform analysis
- Multisim or Tinkercad for circuit simulation
- AC power supplies, RLC components, transformers
- Digital multimeters and clamp meters
- Course text: Comprehensive Course in AC/DC Electronics (Global Specialties)